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10/607,612	06/27/2003	Helene Del Puppo	LAM2P413	8025

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EXAMINER	
TRAN, BINH X	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 01/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/607,612	PUPPO ET AL.	
	Examiner	Art Unit	
	Binh X. Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-12,14,19-24 and 28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-12,14,19-24 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 19-22, 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Becker et al. (US 5,094,712).

Respect to claim 19, Becker discloses a method for enhancing polysilicon (13) to oxide (14) selectivity during an etching process, comprising:

providing a substrate to be plasma etched in a chamber;

striking a plasma in the chamber (col. 8 lines 51-67);

depositing a layer of a silicon containing oxide over a gate oxide (14) as the substrate is being etched, while introducing oxygen (from He/O2 source) into the chamber from a source external to the chamber (col. 9 lines 1-13, col. 10 lines 25-30).

Respect to claims 20, Becker discloses flowing a $SiCl_4$ into the chamber while performing an over etch step of the etching process (col. 8 lines 60-62). Respect to claims 21, 22, Becker discloses depositing a SiO_2 over a gate oxide (14) as the substrate being etched during the over etch step, this causes a polysilicon to oxide selectivity to increase so as to prevent any etching of the gate oxide (Fig 4, col. 9 lines

2-13). Respect to claim, 28, Becker teaches to provide O_2 from an oxygen gas feed source (from He/O2 source) for forming the SiO_2 (col. 9 lines 3-10, col. 10 lines 25-30).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. (US 5,670,397) in view of Yoshida (US 6,265,316).

Respect to claims 1, Chang discloses a method for etching a polysilicon gate structure in a plasma chamber comprising the steps of:

defining a pattern (resist mask layer 14) protecting a polysilicon film (12: 12a and 12b) to be etch (fig 3, col. 4 lines 1-10);

striking a plasma;

etching substantially all of the polysilicon film (12b) that is unprotected (col. 4);

introducing a silicon containing gas (i.e. $SiCl_4$) (col. 4 lines 35-38);

etching a remainder of the polysilicon film (12a) while introducing a silicon containing gas (col. 4 lines 34-46, Fig 4).

Chang fails to disclose the silicon containing gas is selected from the group consisting of SiH_3CH_3, $SiH(CH_3)_3$, $SiHCl_3$, $SiBr_4$, and TEOS at the flow rate greater than 25 sccm. However, Chang clearly teaches to use silicon containing gas $SiCl_4$. In a method for etching polysilicon, Yoshida teaches to use $SiCl_4$ or $SiBr_4$ in order to enhance etching process (col. 5 lines 35-60). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang in view of Yoshida by using $SiBr_4$ because it will enhance the etching process. Further, equivalent and substitution of one for the other would produce an expected result.

Claim 1 differs from Chang and Yoshida by the specific flow rate of silicon containing gas. However, Yoshida teaches the percentage of the silicon containing gas is a result effective variable and it is varying from 8 % or greater. Any person having ordinary skill in the art would be able to convert from volume percentage into individual gas flow rate if the total flow rate of the etchant is known. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, t would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiments to obtain optimal flow rate of silicon containing gas as an expected result.

Respect to claim 4, Yoshida teaches to add SiF_4 into the etchant in order to increase the etch rate and reduce residues (col. 5 lines 45-52). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang in view of Yoshida by using SiF_4 because it will increase the etch rate and reduce residues.

Respect to claim 6, Chang discloses preventing notching at a base of the polysilicon gate structure (See Fig 4).

6. Claims 5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Yoshida as applied to claim 1 above, and further in view of Chow et al. (US 6,872,322).

Respect to claim 5, Chang and Yoshida fails to disclose the step of executing a first etch to remove a hard mask. However, Chang clearly teaches to use photoresist mask and the step of patterning or removing a portion of the photoresist mask (14) to create a pattern and the step of etching the polysilicon to create a gate structure. Chow teaches to execute an etching step to remove a hard mask (i.e. nitride mask) and execute another etch step to remove the polysilicon film (24) that is unprotected (col. 13-14; Table 1-2). Chow further discloses it is possible to use photoresist or a hard mask for the mask layer (col. 12 lines 52-55). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang and Yoshida in view of Chow by using the hard mask because equivalent and substitution of one for the other would produce an expected result. Further the hard mask layer will protect the underlying polysilicon layer during the etching process to create a gate structure.

Respect to claim 7, Chang teaches to terminate the etching of the polysilicon film that is unprotected when the substrate is exposed (Fig 4). However, Chang fail to disclose the overetch process. Chow teaches to terminate the etching of the polysilicon film that is unprotected (i.e. terminating the main etch process) and striking an over etch plasma to completely remove all polysilicon layer that is unprotected (Table 1-2, Fig 4-5). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang and Yoshida in view of Chow by performing an over etch process because it will completely remove all polysilicon layer that is unprotected

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Yoshida as applied to claim 1 above, and further in view of Olson (US 5,705,433).

Respect to claim 8, Chang and Yoshida fail to disclose the step of forming a passivation layer from byproducts generated from the etching of the polysilicon layer. However, Yoshida clearly teaches $SiBr_x$ is byproducts from the etching of polysilicon layer (col. 4 lines 42-45). Olson teaches to form a passivation layer from the etch byproducts such as SiBr, SiF, SiCl, and other silicon containing compound to protect the sidewall from lateral etching (col. 3 lines 25-40). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang and Yoshida in view of Olson by forming a passivation layer from the etch byproducts because it will protect the sidewall from lateral etching.

8. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Olson et al. (US 5,705,433).

Respect to claim 9, Chang discloses a method for etching a substrate comprising:

striking a plasma in a chamber;

etching a dual doped gate structure, wherein the dual doped gate structure includes an n-doped polysilicon gate (i.e. NMOSFET) and p-doped polysilicon gas (i.e. PMOSFET) (See col. 5).

Chang fails to disclose the step of forming a passivation layer from the byproducts generated from etching and enhancing the passivation layer. Olson discloses a method for reducing etch rate micro-loading between different doped material of a substrate (col. 3 lines 1-5) by forming a passivation layer (i.e. sidewall protection layer) from byproducts generated from the etching (col. 3 lines 11-25). Olson also teaches enhancing the passivation layer (col. 3 lines 25-47). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang in view of Olson by forming and enhancing the passivation layer because it will protect the sidewall during the etching process. Respect to claims 10, both Chang and Olson teaches to flow a silicon containing gas into the chamber during etching (Chang's col. 4 lines 36-38; Olson's col. 3 lines 5-10).

Claim 11 differs from Chang and Olson by the specific flow rate value. However, Olson clearly teaches the amount of silicon containing gas is a result effective variable by varying from 4%-8% by volume (col. 4 lines 35-40). The flow rate of individual gas is directly depend on the percentage value with respect to the total gas flow rate. The result effective variable is commonly determined by routine experiment. The process of

conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art.

9. Claims 12, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Olson as applied to claim 10 above, and further in view of Yoshida.

Respect to claim 12, Chang fails to disclose the silicon containing gas is selected from the group consisting of SiH_3CH_3, $SiH(CH_3)_3$, $SiHCl_3$, $SiBr_4$, and TEOS. However, Chang clearly teaches to use silicon containing gas $SiCl_4$. In a method for etching polysilicon, Yoshida teaches to use $SiCl_4$ or $SiBr_4$ in order to enhance etching process (col. 5 lines 35-60). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang and Olson in view of Yoshida by using $SiBr_4$ because it will enhance the etching process. Further, equivalent and substitution of one for the other would produce an expected result.

Respect to claim 14, Yoshida teaches to add SiF_4 into the etchant in order to increase the etch rate and reduce residues (col. 5 lines 45-52). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang and Olson in view of Yoshida by using SiF_4 because it will increase the etch rate and reduce residues.

10. Claims 23-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Baker as applied to claims 20-21 above, and further in view of Yoshida.

Respect to claim 23, Baker fails to disclose the silicon containing gas is selected from the group consisting of SiH_3CH_3, $SiH(CH_3)_3$, $SiHCl_3$, $SiBr_4$, and TEOS. However, Baker clearly teaches to use silicon containing gas $SiCl_4$ (col. 8 line 60). In a method for

etching polysilicon, Yoshida teaches to use $SiCl_4$ or $SiBr_4$ in order to enhance etching process (col. 5 lines 35-60). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Baker in view of Yoshida by using $SiBr_4$ because it will enhance the etching process. Further, equivalent and substitution of one for the other would produce an expected result.

Respect to claim 24, Yoshida teaches to add SiF_4 into the etchant in order to increase the etch rate and reduce residues (col. 5 lines 45-52). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Baker in view of Yoshida by using SiF_4 because it will increase the etch rate and reduce residues.

Response to Arguments

11. The applicants amended independent claims 1 and 9 to overcome the examiner's previous rejection. Since the scope of the independent claims 1 and 9 is changed, the scope of all dependent claims with depend to independent claims 1 or 9 will be changed. Therefore, the applicant's amendment necessitates a new ground of rejections with respect to claims 1, 4-12, 14.

Respect to independent claim 19, the applicant's amendment overcome the 35 USC § 112 2nd paragraph rejection. Thus, the examiner withdraws the previous 35 USC § 112 2nd paragraph rejection. The applicants further argue, "Becker et al. discloses that 'O2 in the air' (See Becker et al. column 9, lines 6-7) forms the silicon oxide layer in the chamber, not O_2 from the source that is external to the plasma chamber". The examiner strongly disagrees. The examiner clearly recognizes that Becker teaches the

sidewall passivation react with the "air" to form silicon oxide during the etching step. However, Baker refers to the oxygen in the air inside the etching chamber (not the air in the regular atmosphere) to form the passivation layer since the pressure inside the chamber is very low (e.g. 1 torr). Since the pressure inside the chamber is very low, it is impossible that the etching chamber is opened and exposed to regular atmosphere (pressure 1 atm = 760 torr) during the etching process. Further, Baker teaches to flow O_2 gas a precise control flow rate into the etching chamber and maintain the pressure inside the chamber at a specific value (col. 10 lines 25-30, 35-38). The oxygen gas certainly must come from the source outside the chamber. The examiner also recognizes that it is possible to use regular "air" as a source for the oxygen gas input under a control flow rate. However, the examiner still considers that the "air" is a source external to the etching chamber. Thus, the examiner still maintains the 35 USC 102(b) rejections with respect to claims 19-22, 28.

The applicants further argue "Chow et al. relates exclusively to a process fro cleaning plasma chambers after etching not a process for etching silicon containing materials". The examiner strongly disagrees. Chow clearly teaches the plasma etching process for polysilicon (read on "silicon containing material", See Table 1-2 in column 13-14). Therefore, the examiner still maintains that Chow is related prior art with respect to the present invention.

The applicant's amendment also necessitates a new ground of rejections with respect to claims 23-24.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER